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## Introduction and Motivation

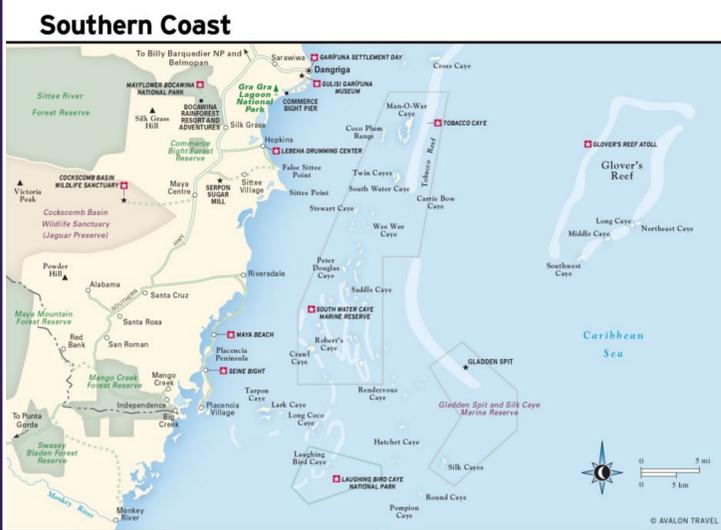
Excess nutrient (nitrogen and phosphate) discharge can cause algal blooms that make coral reefs more vulnerable to climate change and accelerated reef erosion. For coastal communities that depend on fishing and tourism for their livelihood, these effects can be devastating.

A major source of nutrient input is poorly treated wastewater from Onsite Wastewater Treatment Systems (OWTS).

This study investigates the factors that influence the performance of OWTS in the Belizean Cayes where salt water flushing is common.

Using OWTS' owner, maintainer, and user input, a novel community engaged system thinking approach to controlling nutrient pollution will be developed.

## Belize Map

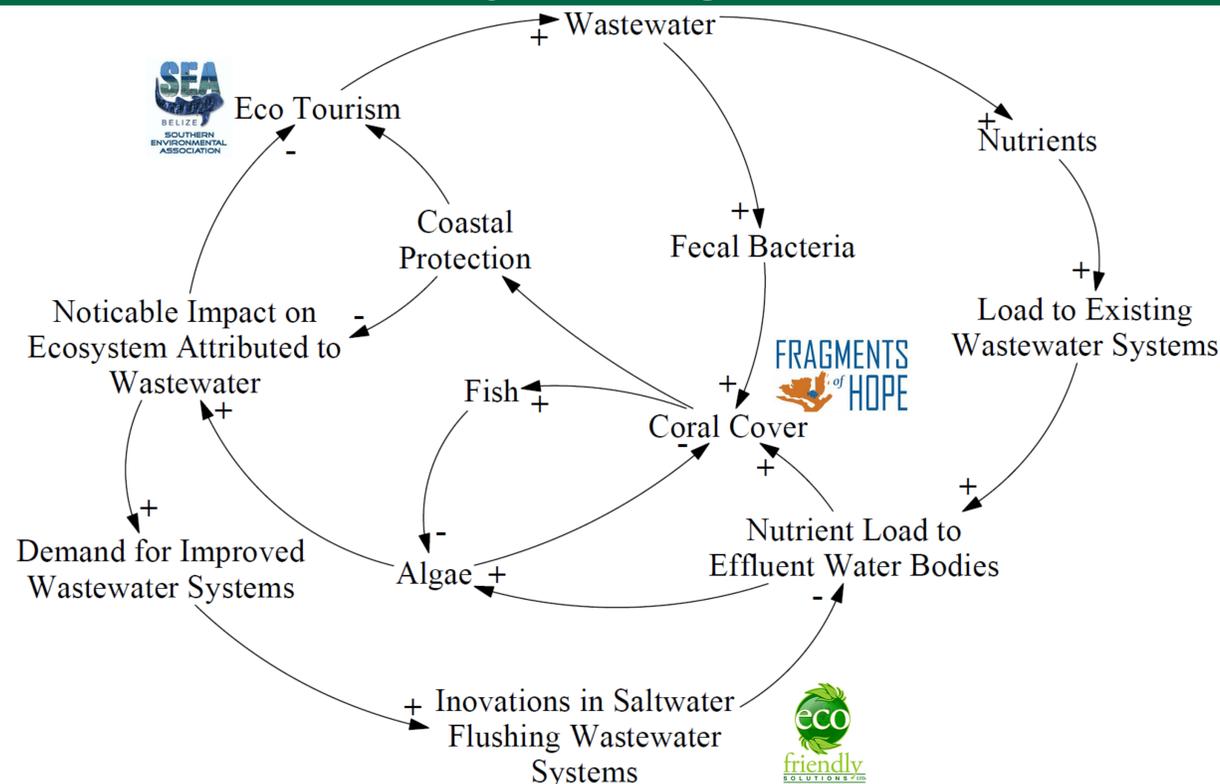


## Acknowledgments



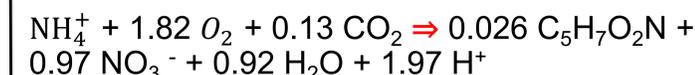
This material is based on work supported by the National Science Foundation under Grant No. 1735320 and by the Sloan Scholar, Alfred P. Sloan Foundation's Minority Ph.D. (MPHD) Program, awarded in 2018-19, Grant No. G-2017-9717. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation or the Alfred P. Sloan Foundation.

## System Diagram

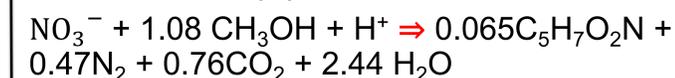


## Biological Reactions

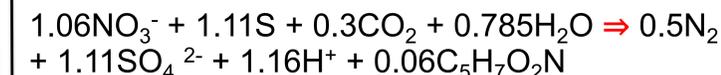
### Nitrification



### Denitrification (H)



### Denitrification (A)



## Conclusions

- The previous systems do not have satisfactory nitrogen removal to prevent harmful algal blooms on nearby coral reef.
- System reconfiguration needed for nitrogen removal.
  - With respect to Electron Donor and Acceptor
  - Recirculation

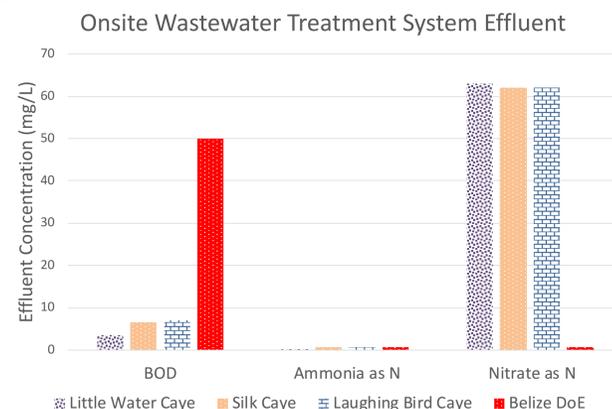
## Future Work

- Create and validate a system model using literature and laboratory experiments
- Evaluate likelihood of failure due to human component.
- Examine the fate of E. coli in new system configuration.
- Work with Fragments of Hope, Eco Friendly Solutions, and Southern Environmental Associations to implement and monitor improved systems.

## Onsite Wastewater Treatment Systems

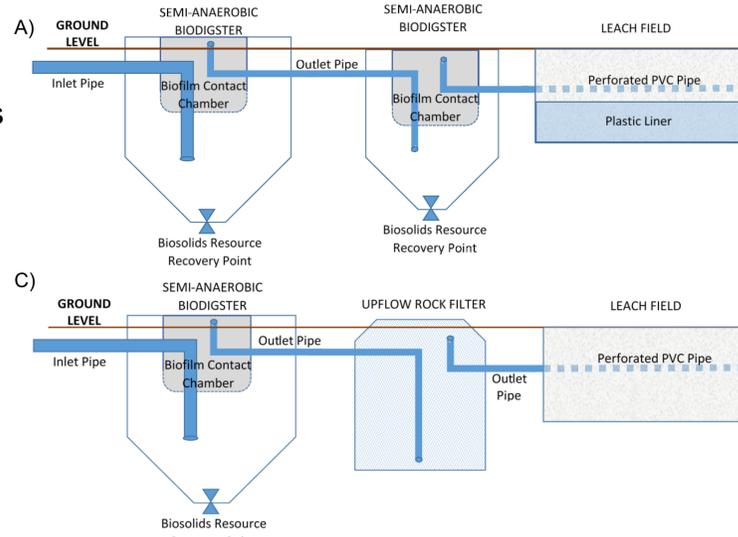
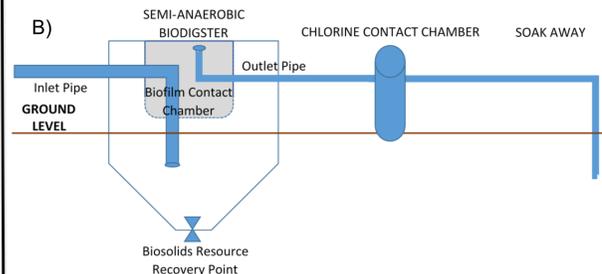


Image: Onsite wastewater treatment system on Laughing Bird Caye

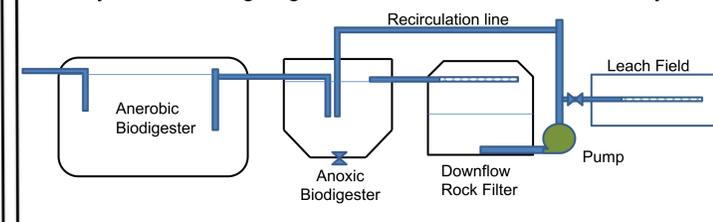


## System Diagrams for OWTs on A) Little Water, B) Silk, and C) Laughing Bird Cayes

Diagrams and data from: Kalivoda, M. D. (2017). Assessment and Modeling of Three Decentralized Resource Recovery Systems in the Cayes of the Belize Barrier Reef. Master's Thesis, Department of Civil & Environmental Engineering, University of South Florida, Tampa, U.S.A.



### New system for Laughing Bird with Recirculation Necessary



### New system for Laughing Bird with Recirculation Not Necessary

